Appendix III

Use Support Methodology and Use Support Ratings

Multiple-Category Use Support Methods

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A. Introduction to Use Support

Surface waters are classified according to their best intended uses. Determining how well a waterbody supports its uses (*use support* status) is an important method of interpreting water quality data and assessing water quality.

Surface waters are rated *fully supporting* (FS), *partially supporting* (PS) or *not supporting* (NS). The terms refer to whether the classified uses of the water (i.e., aquatic life protection, recreation and water supply) are being met. For example, waters classified for fishing and secondary contact recreation (Class C for freshwater or SC for saltwater) are rated FS if data used to determine use support did not exceed specific criteria. However, if these criteria were exceeded, then the waters would be rated as PS or NS, depending on the degree of degradation. Waters rated PS or NS are considered to be impaired. Waters lacking data, or having inconclusive data, are listed as not rated (NR). More specific methods are presented in Part C of this appendix.

Historically, the non-impaired category was subdivided into fully supporting and fully supporting but threatened (ST). ST was used to identify waters that were fully supporting but had some notable water quality concerns and could represent constant, degrading or improving conditions. North Carolina's past use of ST was very different from that of the US Environmental Protection Agency (EPA), which uses it to identify waters that demonstrate declining water quality (EPA Guidelines for Preparation of the Comprehensive State Water Quality Assessments [305(b) Reports] and Electronic Updates, 1997). Given the difference between the EPA and North Carolina definitions of ST and the resulting confusion that arises from this difference, North Carolina no longer subdivides the non-impaired category. However, these waters and the specific water quality concerns remain identified in the basin plans so that data, management and the need to address the identified concerns are not lost.

B. Interpretation of Data and Information

Data used in the use support assessments include biological data, chemical/physical data, lakes assessment data, fish consumption advisories from the NC Department of Health and Human Services, and swimming advisories and shellfish sanitation growing area classification from the NC Division of Environmental Health (as appropriate). Available land cover and land use information is also used, along with water supply reports from regional water treatment plant consultants.

Although there is a general procedure for analyzing the data and information for determining use support ratings, each waterbody is reviewed individually, and best professional judgment is applied during these determinations. Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information available. Refer to Part E for more information on the basis of assessments.

When interpreting the use support ratings, it is important to understand its associated limitations and degree of uncertainty. The assessments are not intended to provide precise conclusions

about pollutant budgets for specific watersheds. Rather, the intent of use support assessments is to gain an overall picture of water quality, to describe how well surface waters support the uses for which they were classified, and to document the potential contribution made by different pollution sources.

C. Assessment Methodology

Beginning in 2000 with the *Roanoke River Basinwide Water Quality Plan*, DWQ assesses ecosystem health and human health risk through several use support categories. Six categories are used to assess this approach: aquatic life and secondary recreation, fish consumption, shellfish harvesting, primary recreation, water supply and "other" uses. These categories are tied to the primary classifications applied to NC rivers and streams. A single water could have more than one use support rating corresponding to one or more of the multiple use support categories, as shown in the table below. For many waters, a use support category will not be applicable (N/A) to the best use classification of that water (e.g., shellfish harvesting is not a best use of a Class SC water). A full description of the stream classifications is available in the DWQ document titled: *Classifications and Water Quality Standards Applicable to Surface Waters of North Carolina*.

	Use Support Categories					
Primary Classification	Ecosystem Approach	Human Health Approach				
	Aquatic Life/Secondary Recreation	Fish Consumption	Primary Recreation	Water Supply	Shellfish Harvesting	Other
С	X	X	N/A	N/A	N/A	X
SC	X	X	N/A	N/A	N/A	X
В	X	X	X	N/A	N/A	X
SB	X	X	X	N/A	N/A	X
SA	X	X	X	N/A	X	X
WS I – WS IV	X	X	N/A	X	N/A	X

Many types of information are used to determine use support ratings and to identify causes and sources of use support impairment. A use support data file is maintained for each of the 17 river basins. In these files, stream segments are listed as individual records. All existing data pertaining to a stream segment are entered into its record. The following describes the data and methodologies used to make use support assessments for the surface water classifications (described in Section A, Chapter 3 of each basin plan) using the six use support categories. These methods will continue to be refined, as additional information becomes available.

Aquatic Life and Secondary Recreation Use Support

The aquatic life and secondary recreation use support category is an ecosystem approach to assess whether aquatic life (benthic macroinvertebrates and fish) can live in and reproduce in the waters of the state and whether waters support secondary recreation (i.e., wading, boating and

minimal human body contact with water). This category is applied to all waters of the state. Biological data, ambient monitoring data and NPDES discharger data are all considered in assessing the aquatic life and secondary recreation use support category. The following is a description of each data type and methods used to assess how well a water is meeting the criteria for aquatic life and secondary recreation protection.

Biological Data

There are two main types of biological data: benthic marcoinvertebrates and fish community. Where recent data for both benthic macroinvertebrates and fish communities are available, both are evaluated in assessing use support. It is important to note that where both ambient data and biological data are available, biological data are given greater weight.

Benthic Macroinvertebrate Bioclassification

Criteria have been developed to assign bioclassifications ranging from Poor to Excellent to each benthic macroinvertebrate sample based on the number of taxa present in the pollution intolerant aquatic insects groups of *Ephemeroptera*, *Plecoptera* and *Trichoptera* (EPTs) and the Biotic Index (BI), which summarizes tolerance data for all taxa in each collection. The benthos bioclassifications are translated to use support ratings according to the following scheme:

Bioclassification	Use Support Rating
Excellent	Fully Supporting (FS)
Good	Fully Supporting (FS)
Good-Fair	Fully Supporting (FS)
Fair	Partially Supporting (PS)
Poor	Not Supporting (NS)

Due to the increased emphasis put on Fair or Poor bioclassifications and the borderline nature of some bioclassifications, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Benthic Macroinvertebrate Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	1 st sample Bioclassification	Draft Use Support Rating	2 nd sample Bioclassification	Final Use Support Rating
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A - Not Applicable NR = Not Rated

The use of benthic macroinvertebrate data can be limited in some waters. The accumulation of swamp stream data over nearly a decade suggests that not all swamp streams support similar fauna. The development of swamp stream criteria is complex, and one set of criteria is likely not appropriate for all swamp streams. Benthic macroinvertebrate data will not be used in waters characterized or classified by DWQ as swamp waters until the biological rating criteria for these waters can be used with confidence.

Benthic macroinvertebrate data are not used to develop use support ratings for estuarine waters. DWQ is attempting to develop biological rating criteria for estuarine waters.

Benthic macroinvertebrate data are used to provide bioclassifications for high elevation trout streams. These benthos data, while not a direct measure of the trout population, are a robust measure of stream integrity. Loss of canopy, increase in stream temperature, increased nutrients, toxicity and increased sedimentation will affect the benthos and fish community. For these reasons, the benthos bioclassifications provide a valuable assessment of the integrity of trout waters.

Fish Community Bioclassification

The North Carolina Index of Biotic Integrity (NCIBI) is a method for assessing a stream's biological integrity by examining the structure and health of its fish community. The index incorporates information about species richness and composition, indicator species, trophic function, abundance and condition, and reproductive function. The index is translated to use support rating according to the following scheme:

NCIBI

Excellent

Good

Good-Fair

Fair

Poor

Poor

Use Support Rating

Fully Supporting (FS)

Fully Supporting (FS)

Fully Supporting (FS)

Partially Supporting (PS)

Not Supporting (NS)

The NCIBI was recently revised by DWQ (NCDENR, 2001). Currently, the focus of using and applying the NCIBI is restricted to wadeable streams that can be sampled by a crew of four persons. Infrequently, larger wadeable streams can be sampled if there is a crew of six persons. The bioclassifications and criteria have also been recalibrated against regional reference site data (BAU, 2000a, 2000b and 2001).

Criteria and ratings are applicable only to wadeable streams in the following river basins: Broad, Catawba, Savannah, Yadkin-Pee Dee, Cape Fear, Neuse, Roanoke, Tar-Pamilco, French Broad, Hiwassee, Little Tennessee, New and Watauga. In the Cape Fear, Neuse, Roanoke and Tar River basins, the criteria and ratings are only applicable to streams in the piedmont portion of these basins. The definition of the "piedmont" for these four river basins is based upon a map of North Carolina watersheds (Fels, 1997). Specifically:

- In the Cape Fear River basin -- except for the streams draining the Sandhills in Moore, Lee and Harnett counties; the entire basin upstream of Lillington, NC.
- In the Neuse River basin -- the entire basin above Smithfield and Wilson, NC, except for the south and southwest portions of Johnston County and the eastern two-thirds of Wilson County.
- In the Roanoke River basin -- the entire basin in North Carolina upstream of Roanoke Rapids, NC and a small area between Roanoke Rapids and Halifax, NC.
- In the Tar-Pamlico River basin -- the entire basin above Rocky Mount, NC, except for the lower southeastern one-half of Halifax County and the extreme eastern portion of Nash County.

Criteria and ratings have not been developed for:

- Streams in the Broad, Catawba, Yadkin-Pee Dee, Savannah, French Broad, Hiwassee, Little Tennessee, New and Watauga River basins which are characterized as wadeable first to third order streams with small watersheds, naturally low fish species diversity, cold water temperatures, and high gradient plunge-pool flows. Such streams are typically thought of as "Southern Appalachian Trout Streams".
- Wadeable streams in the Sandhills ecoregion of the Cape Fear, Lumber and Yadkin-Pee Dee River basins.
- Wadeable streams and swamps in the coastal plain region of the Cape Fear, Chowan, Lumber, Neuse, Pasquotank, Roanoke, Tar-Pamlico and White Oak River basins.
- All non-wadeable and large streams and rivers throughout the state.

Due to the increased emphasis put on Fair or Poor bioclassifications and the borderline nature of some bioclassifications, sites should be resampled within 12-24 months after a Fair rating is obtained in 1999 and beyond, if this Fair rating will result in a lower use support rating or if data

are from a site never sampled before. This resampling will be done to validate the Fair bioclassification. Such sites will not be given a use support rating until the second sample is obtained. The table below shows how a final use support rating is obtained for sites that are resampled.

New Fish Community Classifications (1999 and Beyond) and Data Causing a Decline in Use Support Ratings				
Pre-1999 Bioclassification	1 st sample Bioclassification	Draft Use Support Rating	2 nd sample Bioclassification	Final Use Support Rating
N/A	Fair	NR; resample	Good-Fair, Good or Excellent	FS
N/A	Fair	NR; resample	Fair	PS
N/A	Fair	NR; resample	Poor	NS
N/A	Poor	NS	N/A	NS
Good-Fair, Good or Excellent	Fair	NR; resample	Good-Fair, Good or Excellent	FS
Good-Fair, Good or Excellent	Fair	NR; resample	Fair	PS
Good-Fair, Good or Excellent	Fair	NR; resample	Poor	NS
Good-Fair, Good or Excellent	Poor	NS	N/A	NS

N/A – Not Applicable

NR = Not Rated

Ambient Monitoring Data

Chemical/physical water quality data are collected through the DWQ Ambient Monitoring System. These data are downloaded from the ambient database, the Surface Water Information Management System, for analysis. Total number of samples and percent of samples exceeding the NC standards are used for use support ratings along with other data or alone when other data are not available. Where both ambient data and biological data are available, biological data are given greater weight.

When reviewing ambient data, a five-year window of data that ends on August 31 of the year of biological sampling is used. For example, if a basin is sampled in 2000, then the five-year window for the basin would be September 1, 1995 to August 31, 2000. Selected ambient parameters are used to assess aquatic life/secondary recreation use support. These parameters include NH₃, dissolved oxygen, pH, Cl, As, Cd, Cr, Ni and Pb. These parameters are measured against standards for a minimum of ten samples as follows:

Standards Violation	Rating
Criterion exceeded ≤10% Criterion exceeded 11-25%	Fully Supporting (FS) Partially Supporting (PS)
Criterion exceeded >25%	Not Supporting (NS)

Data for copper, iron and zinc are not used according to the percent criterion exceeded scheme outlined above. These metals have action level standards because they are generally not bioaccumulative and have variable toxicity to aquatic life depending on chemical form, solubility and stream characteristics. In order for an action level standard to be violated, there must be a toxicological test that documents an impact on a sensitive aquatic organism. The action level standard is used to screen waters for potential problems with copper, iron and zinc.

Metals data for Cu and Fe are screened at the 85^{th} percentile of five years of ambient data ending on August 31 of the year of biological sampling. Sites, other than estuarine and swamp waters, with an 85^{th} percentile of $\geq 20~\mu g/l$ of Cu and/or $\geq 2000~\mu g/l$ of Fe are identified and flagged for instream chronic toxicity testing by DWQ. Chronic toxicity testing in estuarine and swamp waters is not ecologically meaningful. Criteria are still being developed for zinc. If a stream does not have biological data that would deem a FS rating, then the stream can be rated PS or NS for aquatic life if instream chronic toxicity is found. Criteria for evaluating instream chronic toxicity are three chronic pass/fail tests over three months using *Ceriodaphnia*. Three fails result in a NS rating, and two fails result in a PS rating.

It is important to note that some waters may exhibit characteristics outside the appropriate standards due to natural conditions (e.g., many swamp waters are characterized by low pH and dissolved oxygen). These natural conditions do not constitute a violation of water quality standards.

NPDES Discharger Data

Aquatic Toxicity Data

For facilities that perform Whole Effluent Toxicity (WET) tests per state NPDES discharge permit requirements, a review of the results of a five-year window of data that ends on August 31 of the year of biological sampling is used. For example, if a basin is sampled in 2000, then the five-year window for the basin would be September 1, 1995 to August 31, 2000. If a stream with a WET test facility has not been sampled for instream chronic toxicity, biological community data or has no ambient data, and that facility has ≥3 fails in the most recent 2 years, the stream is not rated. If failures continue, DWQ will work with the facility to correct the failures and assess stream impacts before the next basin sampling cycle begins with either a biological survey or instream chronic toxicity testing, if possible.

Discharge Effluent Data

NPDES effluent data are reviewed by analyzing monthly averages of water quality parameters over a two-year period (date ending on August 31 of the year of biological sampling). Prior to May 31, 2000, facilities are screened for criterion 40 percent in excess of state standards for conventional pollutant limitations or 20 percent in excess of state standards for toxic pollutants for two or more months during two consecutive quarter review periods or chronic violations of either conventional or toxic pollutant limitations for four or more months during 2 consecutive quarter review periods. After May 31, 2000, facilities are screened for criterion 20 percent in excess of state standards for both conventional and toxic pollutants for two or more months during two consecutive quarter review periods or chronic violations of either conventional or toxic pollutant limitations for four or more months during 2 consecutive quarter review periods.

Streams with discharges that are in excess of permit limits will not be rated if no biological or ambient monitoring data are available. Therefore, streams will not be rated PS or NS based on effluent data alone. Appropriate DWQ staff will be given a list of these facilities for follow-up.

In special situations, where there are currently insufficient biological data available, the basinwide planner will make a request of the DWQ Environmental Sciences Branch to determine whether a biological survey is appropriate. If a biological survey is appropriate, the stream rating will be determined by the bioclassification resulting from the survey. If a biological survey is not appropriate, then the stream will be given a NR rating.

Problem Parameters

Where an ambient parameter is identified as a potential concern, the parameter is listed in the DWQ database and use support summary table. Where habitat degradation is identified by DWQ biologists based on site visits, it is listed and attempts are made to identify the type of habitat degradation (e.g., sedimentation, loss of woody habitat, loss of pools, loss of riffles, channelization, lack of riparian vegetation, streambed scour and bank erosion). Habitat evaluation methods are being developed to better identify specific types of habitat degradation.

Sources

General nonpoint sources (NPS) and point sources (PS) of pollution are identified where there is sufficient information.

Basis of Assessment

FS ratings are extrapolated up tributaries from monitored streams when no problematic dischargers or change in land use/cover are identified. The FS rating may be applied to unmonitored tributaries where there is little land disturbance (e.g., national forests). Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS ratings are not extrapolated to unmonitored tributaries. Refer to Part E for more information.

Fish Consumption Use Support

The fish consumption use support category is a human health approach to assess whether humans can safely consume fish from a water. This use support category is applied to all waters of the state. The use support rating is assigned using fish consumption advisories issued by the NC Department of Health and Human Services.

If a limited fish consumption advisory is posted at the time of use support assessment, the water is rated PS. If a no consumption advisory is posted at the time of use support assessment, the water is rated NS.

The current statewide limited fish consumption advisory for bowfin due to elevated levels of mercury in fish tissue is an exception. It is recognized that bowfin only live and reproduce in waters of the piedmont and coastal plain. Therefore, the use support ratings will be based on the combination of current statewide fish consumption advisory for bowfin and the documented presence of bowfin in each river basin as found in *Freshwater Fisheries of North Carolina*

(Menhinick, 1991). In river basins where there are documented populations of bowfin (Roanoke, Chowan, Pasquotank, White Oak, Lumber, Neuse, Tar-Pamilco, Cape Fear, Yadkin and Catawba), the waters will be rated PS for the fish consumption category. In river basins where there are no documented populations of bowfin (Little Tennesee, Hiwassee, Savannah, Watauga, New, French Broad and Broad), the waters will be rated FS for the fish consumption category unless there is a site-specific advisory. In order to separate out other fish consumption advisories and to identify actual bowfin populations with high levels of mercury, only waters with fish tissue monitoring data are presented on the use support maps and in the use support summary tables. A review of the present methods for assessing the fish consumption use support category is being conducted, and methods may be modified in the future.

Only those waters that have been monitored for fish tissue and do not have an advisory are rated FS. Only waters sampled from 1989 on are considered, because these waters were sampled using more rigorous methods than those sampled before this date. All waters not monitored or evaluated and without advisories are not rated.

Primary Recreation Use Support

In addition to the use support categories applicable to Class C and SC waters, the primary recreation use support category will be assessed for all Class B, Class SA and Class SB waters where data are available. This use support category is a human health approach to assess whether waters support primary recreation activities such as swimming, water-skiing, skin diving, and similar uses involving human body contact in an organized or frequent basis. The use support rating is based on swimming advisories issued by local health departments and by the NC Division of Environmental Health (DEH) beach monitoring program.

Freshwaters

Fecal coliform bacteria data are used to assess Class B waters. Each January, the geometric mean for ambient stations in Class B waters for the prior sampling year is obtained, and a screen is conducted for waters with geometric means >200 colonies per 100 ml. Monitored Class B waters are rated FS if the geometric mean is ≤200 colonies per 100 ml. If the geometric mean is >200 colonies per 100 ml during the past year, fecal coliform bacteria are noted as a problem parameter, and a request is made of the DWQ regional office to sample this water 5 times/30 days in June during non-runoff events, if possible. If this 5 times/30-day monitoring, as required to assess the NC standard, indicates a geometric mean above 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWQ regional office should continue to sample the stream 5 times/30 days during the months of July and August and send the data to DEH.

If a water is posted with an advisory for at least two months in the past five years ending on August 31 of the year of biological sampling, it is rated as PS unless DEH staff believes that the cause of fecal problems is not persistent. Those waters posted as "Do Not Swim" for more than two months in the past five years are rated NS. Class B waters without fecal or advisory data are not rated.

DWQ attempts to determine if there are any inland swimming areas monitored by county or local health departments. County or local health departments are asked to list those waters with

swimming advisories posted for at least two months in the past five years ending on August 31 of the year of biological sampling.

Estuarine waters

DEH fecal coliform data are used to assess estuarine (SA and SB) waters. Each January, DEH submits a letter to DWO stating which coastal waters were posted with an advisory reporting an increased risk from swimming during the prior year. Those Class SA or SB waters with an advisory for at least two months in the past five years ending on August 31 of the year of biological sampling are rated PS, unless DEH staff believes that the cause of fecal problems is not persistent. Those waters posted as "Do Not Swim" for more than two months in the past five years are rated NS. If DEH has no data on a water, that water will not be rated. If ambient data show fecal coliform bacteria geometric mean of >200 colonies per 100 ml, then a request is made of the DWQ regional office to sample this water 5 times/30 days in June during non-runoff events, if possible. If this 5 times/30-day monitoring, as required to assess the NC standard, indicates a geometric mean above 200 colonies per 100 ml, then the data are sent to DEH for consideration of posting swimming advisories. The DWO regional office should continue to sample the water 5 times/30 days during the months of July and August and send the data to DEH. Because North Carolina's fecal coliform bacteria standard is 200 colonies per 100 ml for the geometric mean of five samples taken in a thirty-day period, fecal coliform bacteria are listed as a cause of impairment for the 303(d) list only when additional sampling has determined that the standard is being exceeded.

Shellfish Harvesting Use Support

The shellfish harvesting use support category is a human health approach to assess whether shellfish can be harvested for commercial purposes and is therefore applied only to Class SA waters. Many types of information are used to determine use support ratings for shellfish waters and to determine causes and sources of impairment for these waters. The following data sources are used when assessing estuarine areas.

DEH Shellfish Sanitation Surveys

DEH is required to classify all shellfish growing areas as to their suitability for shellfish harvesting. DEH samples growing areas continuously and reevaluates the areas every three years to determine if their classification is still applicable. Classifications are based on DEH fecal coliform bacteria sampling, locations of pollution sources and the availability of the shellfish resource. Growing waters are classified as follows:

DEH Classification	DEH Criteria
Approved	No contamination with fecal material, pathogenic organisms, poisonous or deleterious
(APP)	substances, or marine biotoxins.
Conditionally Approved-Open	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
(CAO)	
Conditionally Approved-Closed (CAC)	Sanitary Survey indicates an area can meet approved area criteria for a reasonable period of time, and the pollutant event is known and predictable and can be managed by a plan.
Restricted (RES)	Sanitary Survey indicates limited degree of pollution, and the area is not contaminated to the extent that consumption of shellfish could be hazardous after controlled depuration or relaying.
Prohibited (PRO)	No Sanitary Survey; point source discharges; marinas; data does not meet criteria for Approved, Conditionally Approved or Restricted Classification.

Assigning Use Support Ratings to Shellfish Harvesting Waters (Class SA)

Estuarine waters are delineated according to Division of Environmental Health (DEH) shellfish management areas (e.g., Outer Banks, Area H-5) which include SA, SB and SC waters. DEH shellfish classifications are gleaned from the most recent sanitary survey (updated every 3 years). DEH classifications may be changed after the most recent sanitary survey.

It is important to note that DEH classifies <u>all</u> actual and potential growing areas (which includes all saltwater and brackish water areas) for their suitability for shellfish harvesting. Thus, the DWQ classified SA waters must be separated out and rated for shellfish harvesting use support. The acreage of FS, PS and NS waters are calculated using GIS showing DWQ and DEH classifications as attribute information attached to the polygon coverage. However, the DEH "Closed" polygon coverage includes CAC, RES and PRO classifications, and it is not currently possible to separate out the PRO from the RES areas. Therefore, these areas are a combined polygon coverage, and DWQ rates these waters as NS.

DWQ use support ratings may be assigned to separate segments within DEH management areas. In assessing use support, the DEH classifications and management strategies are only applicable to those areas that DWQ has classified as SA (shellfish harvesting waters). This will result in a difference of acreage between DEH areas classified as CAC, PRO, RES and DWQ waters rated as PS or NS. For example, if DEH classifies a 20-acre area CAC, but only 10 acres have a DWQ classification of SA, only those 10 acres classified as SA are rated as PS.

Sources of fecal coliform bacteria are more difficult to separate out for SA areas. DEH describes the potential sources in the sanitary surveys, but they do not describe specific areas affected by specific sources. Therefore, in the past, DEH identified the same sources for all SA sections of an entire management area (e.g., urban runoff and septic systems). Until a better way to pinpoint sources is developed, this procedure will continue to be used. A point source discharger is only listed as a potential source when permit parameters are exceeded.

DWQ and DEH SS are developing the database and expertise necessary to assess shellfish harvesting use support using a frequency of closures based approach. This database will allow DWQ to better assess the extent and duration of closures in Class SA waters. These tools will not be available for use support determinations in Class SA waters for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin use support assessments. DWQ believes it is important to identify frequency of closures in these waters, so an interim methodology will be used based on existing databases and GIS shapefiles. There will likely be changes in reported acreages in future assessments using the permanent methods and tools that result from this project. DWQ and DEH hope to have these tools fully developed for using the permanent frequency of closure based methods for the 2005 Cape Fear River basin plan use support assessment.

Interim Frequency of Closure Based Assessment Methodology

The interim method will be used for the 2001 White Oak, 2002 Neuse and 2003 Lumber River basin assessments. Shellfish harvesting use support ratings for Class SA waters using the interim methodology are summarized below.

Interim Frequency of Closure Based Use Support Ratings

Percent of Time Closed within Basin Data Window	DEH SS Growing Area Classification	DWQ Use Support Rating
N/A	Approved*	FS
Closed ≤10% of data window	Portion of CAO closed ≤10%	FS
Closed >10% to ≤25% of data window	Portion of CAO closed >10% to ≤25% of data window	PS
Closed >25% of data window	Portion of CAO closed >25% of data window	NS
N/A	CAC and P/R**	NS

^{*} Approved waters are closed only during extreme meteorological events (hurricanes).

For CAO areas, DWQ will work with DEH SS to determine the number of days and acreages that CAO Class SA waters were closed to shellfish harvesting during a five-year window of data that ends on August 31 of the year of biological sampling. For example, if a basin is sampled in 2000, then the five-year window for the basin would be September 1, 1995 to August 31, 2000. For each growing area with CAO Class SA waters, DEH SS and DWQ staff will define subareas (within the larger conditionally approved-open area) that were opened and closed at the same time. The number of days these CAO waters were closed will be determined using proclamation summary sheets and the original proclamations.

The number of days that approved areas in the growing area were closed due to pre-emptive closures because of named storms are not counted. For example, all waters in growing area E-9 were pre-emptively closed for Hurricane Fran on September 5, 1996. APP waters were reopened September 20, 1996. Nelson Bay (conditionally approved-open) was reopened September 30, 1996. This area was considered closed for 10 days after the APP waters were reopened.

^{**} CAC and P/R waters are rarely opened to shellfish harvesting.

Proposed Permanent Frequency of Closures Based Assessment Methodology

Over the next few years DWQ, DEH SS, Division of Coastal Management (DCM) and Division of Marine Fisheries (DMF) will be engaged in developing a fully functionally database with related georeferenced (GIS) shellfish harvesting areas. The new database and GIS tools will be valuable for the above agencies to continue to better serve the public. DWQ proposes to use information generated by these new tools to do frequency of closures based shellfish harvesting use support assessments in Class SA waters, starting with the 2005 Cape Fear River basin use support assessment.

Using the new database with georeferenced areas and monitoring sites, DEH SS will be able to report the number of days each area was closed excluding closures related to named storms. The percent of the five-year data window that individual Class SA waters are closed will be used to make use support determinations for areas that are classified by DEH SS as CAO. PRO, RES and CAC waters will be rated NS and CAO waters will be rated FS, PS or NS based on the methodology outlined above in the interim methods. Waters that have been reclassified (by DEH SS) during the data window from a lower classification to APP will be rated FS. Waters that are reclassified from APP to CAO during the data window will be rated as described above in the interim methods, taking into account the total days closed during the data window, including when the area was classified as APP.

Water Supply Use Support

This use support category is used to assess all Class WS waters. The water supply use support category is a human health approach to assess whether a water can be safely consumed after adequate treatment. Most drinking water supplies in NC are drawn from human-made reservoirs that often have multiple uses.

Water supply use support is assessed using information from the seven regional water treatment plant (WTP) consultants. Each January, the WTP consultants will submit a spreadsheet listing each closure and water intake switch-over for every water treatment plant in their region. This spreadsheet will describe the length and time of the event, contact information for the WTP, and the cause of the closure or switch.

Use support for water supply will be fine-tuned to determine what closures/switches were due to water quality concerns. Those closures/switches due to water quantity and reservoir turnovers will not be considered for use support. The frequency and duration of closures/switches due to water quality concerns are considered when assessing use support. In general, North Carolina's surface water supplies are in good condition and most, if not all, will be rated FS. Specific criteria for rating waters PS or NS are yet to be determined.

Other Uses: All Waters in the State

This category of use will be assessed infrequently but could be applied to any water in the state. Examples of uses that fall into this category are aesthetics and industrial and agricultural water supply. This category allows for the assessment of any use that is not considered by aquatic life and secondary recreation, primary recreation, fish consumption, shellfish harvesting or water supply.

D. Use of Outside Data

DWQ actively solicits outside data and information in October prior to the basinwide sampling year. The solicitation allows for approximately 60 days to submit data. Data from sources outside DWQ are screened for data quality and quantity. If data are of sufficient quality and quantity, they may be incorporated into use support assessments. A minimum of ten samples for more than a one-year period is needed to be considered for use support assessments. The way the data are used depends on the degree of quality assurance and quality control of the collection and analysis of the data as detailed in the draft 2000 303(d) report and shown in the table below. Level 1 data can be used in the same fashion as DWQ data to determine use support ratings. Level 2 or Level 3 data may be used to help identify causes of pollution and problem parameters. They may also be used to limit the extrapolation of use support ratings up or down a stream from a DWQ monitoring location. Where outside data indicate a potential problem, DWQ evaluates the existing DWQ biological and ambient monitoring site locations for adjustment as appropriate.

Criteria Levels for Use of Outside Data in Use Support Assessments			
Criteria	Level 1	Level 2	Level 3
Monitoring frequency of at least 10 samples for more than a one-year period	Yes	Yes/No	No
Monitoring locations appropriately sited and mapped	Yes	Yes	No
State certified laboratory used for analysis according to 15A NCAC 2B .0103	Yes	Yes/No	No
Quality assurance plan available describing sample collection and handling	Yes, rigorous scrutiny	Yes/No	No

E. Monitored vs. Evaluated

Assessments are made on either a monitored (M) or evaluated (E) basis depending on the level of information that was available. Because a monitored rating is based on the most recent five-year window and site-specific data, it is treated with more confidence than an evaluated rating.

FS ratings are extrapolated up tributaries to monitored streams where there are no dischargers with permit violations or changes in land use/cover. Problem parameters or sources (except general NPS) are not applied to unmonitored tributaries. PS or NS ratings are not applied to unmonitored tributaries. Refer to the following summary for the basis of assigning use support ratings.

Summary of Basis for Assigning Use Support Ratings to Freshwater Streams			
Overall Basis	Specific Basis	Description	
Monitored	Monitored (M)	Monitored stream segments ^a with data ^b $\leq 5^c$ years old.	
	Monitored/Evaluated (ME)	Stream segment ^a is unmonitored, but is assigned a use support rating based on another segment of same stream for which data ^b $\leq 5^{c}$ years old are available.	
Evaluated	Evaluated (E)	Unmonitored streams that are direct or indirect tributaries to monitored stream segments rated FS. Must share similar land use to the monitored stream segment.	
	Evaluated/Old Data (ED)	Monitored stream segments ^a with available data ^b >5 ^c years old.	
Not Rated	Not Rated (NR)	Insufficient or no data available to determine use support. Includes unmonitored streams that are direct or indirect tributaries to stream segments rated PS or NS.	

a) A stream segment is a stream, or a portion thereof, listed in the Classifications and Water Quality Standards for a river basin. Each segment is assigned a unique identification number (index number).

- b) Major data sources include benthic macroinvertebrate bioclassifications and chemical/physical monitoring data.
- c) From the year that basin monitoring was done.

F. Nutrient Enrichment Issues

The complex and dynamic ecosystem interactions that link chemical and physical water quality parameters and biological response variables must be considered when evaluating use support. In general, North Carolina assesses use support by determining if a water's *uses*, such as water supply, fishing and recreation, are met. Violations of water quality standards in lakes or estuaries are not equated with use impairment unless uses are not met. In following this approach, use support for aquatic life propagation, maintenance of biological integrity, recreation and water supply can be holistically evaluated.

One of the main causes of impacts to lakes is nutrient enrichment, or eutrophication. Several water quality variables may help to describe the level of eutrophication. These include pH, chlorophyll *a*, dissolved oxygen, phosphorus, nitrogen, turbidity, total dissolved gases and other quantitative indicators, some of which have specific water quality standards. It is generally agreed that excessive amounts of nitrogen and phosphorus are the principal culprits in eutrophication related use impairment. These variables are important concerns; however, climate, hydrology and biological response factors (chlorophyll, phytoplankton, fish kills, etc.) are also essential to evaluate because they may control the frequency of episodes related to potential use impairment. In addition, many of North Carolina's lakes are human-made reservoirs that do not mimic natural systems.

North Carolina does not determine eutrophication related use impairment with the quantitative assessment of an individual water quality variable (i.e., chlorophyll *a*). Likewise, North Carolina does not depend on a fixed index composed of several water quality variables, which does not have the flexibility to adapt to numerous hydrological situations, to determine use impairment. Instead, the weight of evidence approach is most appropriate to determine use support in terms of

nutrient enrichment in lakes. This approach can be flexibly applied depending on the amount and quality of available information. The approach uses the following sources of information:

- multiple quantitative water quality variables (e.g., dissolved oxygen, chlorophyll a)
- third party reports
- analysis of water quality complaints
- algal bloom reports
- macrophyte observations
- reports from water treatment plant operators
- reports from lake associations
- fish kill reports
- taste and odor observations
- aesthetic complaints
- frequency of noxious algal activity
- reports/observations of the NC Wildlife Resources Commission

References

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